# Business cycles and wage rigidity☆

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## ABSTRACT

In this paper, we analyze the impact of downward wage rigidity on the labor market dynamics. We shows that imposing downward wage rigidity in a matching model with cyclical fluctuations in productivity, endogenous match-destruction, and on-the-job search, quits are procyclical and layoffs countercyclical. Using the European Community Household Panel (ECHP), we provide evidence that downward wage rigidity is empirically relevant in ten European countries. Finally, we show that layoffs are countercyclical and quits are procyclical, as predicted by the model.

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## 1. Introduction

Downward wage rigidity has traditionally been a central concern in labor economics.[1] Regarding empirical work on downward wage rigidity in Europe, there is now a fairly large and rapidly growing literature base. Devicienti et al. (2007) investigate downward wage rigidity in Italy, Knoppik and Beissinger (2003) in Germany, Holden (1998) in the Nordic countries, Agell and Lundborg (2003) in Sweden, Smith (2000) and Nickell and Quintini (2003) in the UK. There are also some multi country studies based on the European Community Household Panel (ECHP) in Dessy (2002) and Beissinger and Knoppik (2009).

One of the limitations of studies using large nationally representative datasets is that they generally identify wage rigidity by the percent of respondents that experience a decline in nominal wages while working for the same employer in interviews a year apart. Self-reported wages gathered in two different interviews can lead to spurious changes in wages due to measurement error.[2]

In this paper, we first add to this branch of literature by providing robust evidence of downward wage rigidity in ten European Countries using the ECHP.[3] Downward wage rigidity is detected by analyzing the relationship between wages and general economic conditions. The rationale of this strategy is to measure whether wages respond differently when conditions improve than when conditions decline.[4]

One question that emerges from this evidence regards the implications of wage rigidity for job duration. If firms are not free to trigger renegotiation, when there is a cut on demand or a decrease in productivity they will not be able to maintain the job. Therefore we should observe an effect of business cycles on job breaks.

There has been an extensive research assessing the importance of business cycle fluctuations over labor market outcomes in relation to job finding and job destruction rates. Davis et al. (1996) indicate that unemployment inflows and outflows are very volatile and cyclical. Using U.S. firm level data they find that unemployment is clearly countercyclical, that layoffs account for most of its cyclical changes and that quits increase in expansions and decline moderately during recessions.

Analyzing U.S. data, Shimer (2012) concludes that fluctuations in the destruction rate account for 25% of the variation in the unemployment rate. Fujita and Ramey (2009) claim that contemporaneous

[1] See Bauer et al. (2007) for a brief survey of the literature.
[2] There are some empirical models that explicitly account for measurement error. See Altonji and Devereux (2000a) for a good example.

[3] We analyze information from Austria, Denmark, The Netherlands, Belgium, France, Ireland, Italy, Greece, Spain and Portugal.
[4] These measures are robust to measurement error in self-reported wages. Wages are in the left hand side of our regressions. Whenever the measurement error in wages is iid, estimates are unbiased.

fluctuations in the separation rate explain 40 to 50% of the fluctuations in unemployment, depending on how the data are detrended.

In this paper, we formally discuss the relationship between rigidity, layoffs and quits, using a matching model framework. Search and matching models have primarily omitted business cycles and wage renegotiation. In the textbook versions of matching models, the economy is stationary. Therefore, once the agent and the firm have formed a match, the surplus remains constant and there is no reason to set rules for renegotiation.[5]

In the model presented in this paper, wages are set by Nash Bargaining in new matches. For ongoing matches, when conditions deteriorate surplus is not split in the same proportions as in new matches, because firms are not allowed to trigger renegotiation. Allowing different wage setting mechanisms when the worker is an insider and when the worker is an outsider, may be more consistent with some features of European institutions than continuous Nash bargaining. Firms and workers have no commitment when they are setting wages in the beginning of the match. Due to severance payments and difficulty of dismissal regulations, firms are not allowed to costlessly break the relationship. Hence the bargaining rules in ongoing matches could differ from the bargaining rules in new matches. Imposing some rigidity is also consistent with Shimer (2005), who argues that search and matching models where wages are determined by continuous Nash bargaining cannot generate substantial movements along a downward-sloping Beveridge curve in response to shocks to productivity of a plausible magnitude. Therefore, some models with more rigid wages are needed.

This paper proposes a model with cyclical fluctuations in productivity, endogenous job-termination and on-the-job search where downward wage rigidity is imposed. By means of simulating the model, we show that it predicts procyclical quits, countercyclical layoffs and countercyclical unemployment rates.

Using microdata from the same set of ten European countries, we analyze the cyclical patterns of job termination. The estimates of the separation model imply a strong negative relationship between unemployment rates and quits at the European level. We also find a significantly positive effect of the unemployment rate on the probability of layoffs. These results suggest that in Europe, quits are procyclical and layoffs countercyclical, as predicted by the model. We finally test whether downward wage rigidity has an effect of the probability of layoff. We find that the higher the best economic condition of the spell, the higher the probability of a layoff. This evidence suggests that there are inefficient layoffs, where matches with positive surplus are destroyed due to downward rigid wages.

The rest of the paper is organized as follows. The model is described in Section 2. In Section 3, we describe the dataset. Section 4 presents two alternative empirical approaches to detect downward wage rigidity and the empirical strategy to measure the cyclical patterns of job terminations. Results for the pooled sample of countries and for each country individually are also presented in this section. Section 5 discusses the results and informally connects these results with the institutional background of each country. Section 6 concludes and presents recommendations for future research.

## 2. The model

The labor market is described by a matching model with cyclical fluctuations in productivity, on-the-job search and endogenous match-destruction. To introduce a cyclical component in the model is not trivial: there is not a consensus on how much flexibility to allow in wages. There have been two main streams. One possible direction is to consider that one job is one wage, and to not allow any renegotiation. Lippman and Mamer (1989) for example, set up cyclical variation in a rigid wage search
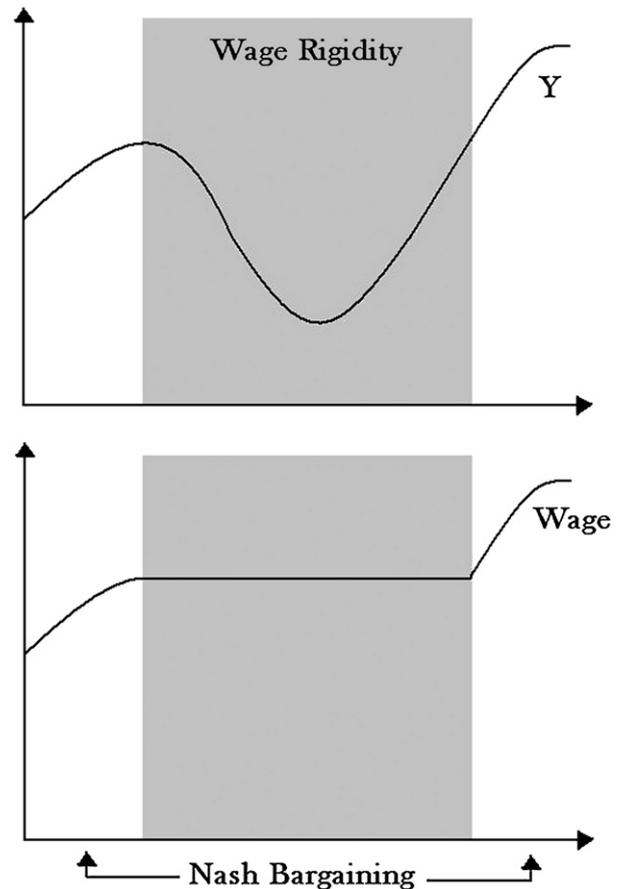


**Fig. 1.** Wage setting dynamics.

model where no renegotiation is permitted. Their model predicts procyclical quits but says nothing about layoffs. The opposite direction is to allow for continuous Nash bargaining, where wages are consequently governed by the current market condition. Mortensen (1994) considers a matching model with two sources of variation. It predicts countercyclical layoffs and procyclical quits.[6] The model presented in this section is halfway between both positions, wages can only be renegotiated upward.

Our model builds on the Mortensen and Pissarides (1994), except that now firms are heterogeneous and wages are assumed to be downward rigid. Each firm has a job that can be either filled or vacant and searching. Jobs that are not searching for a worker or producing are destroyed. Similarly, workers can be producing or searching. To search while employed is allowed as in Mortensen (1994).[7] We assume that searching while working is less productive than searching while the worker is unemployed.

At the moment of hiring, the wage is chosen so as to split the current surplus in a fixed proportion. We impose downward wage rigidity, hence if the surplus changes, the wage response will be asymmetric (see Fig. 1). There are two cases. If conditions improve, the worker renegotiates to maintain her proportion of the new surplus and the wage increases. If conditions deteriorate, the worker does not renegotiate, the wage does not change, and the firm obtains a lower profit (but only if the value of job for the firm remains positive).[8]

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[5] For good examples of classical search and matching models see Wolpin (1995) and Pissarides (1985).

[6] Mortensen (1994) imputes a layoff when both parts break the match due to the surplus extinction. This definition might not be complete if we think in a layoff as a job destruction initiated by the firm.

[7] This *on-the-job search* only implies that it is not necessary to be unemployed to look for a new job, it is not the same offer and counter-offer scheme like in Burdett and Mortensen (1998). The outside option is always the unemployment.

[8] We consider a layoff as a match break initiated by the firm and a quit as a match break initiated by the worker.